

What's It Worth?

Reporting Category Patterns, Functions, and Algebra

Topic Investigating equality and the associative property

Vocabulary

equation, value, commutative property for addition, commutative property for multiplication, associative property for addition, associative property for multiplication

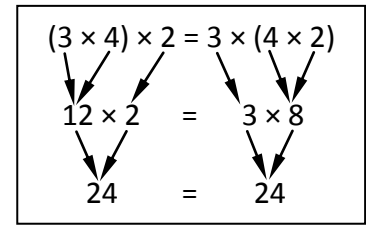
Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Review the commutative property for addition. Write an example on the board, such as the equation $4 + 5 = 5 + 4$, and ask students how this is possible. (Because $9 = 9$) Then, write the equation $7 \times 6 = 6 \times 7$, and ask whether this is true. Have students explain why or why not. (Yes, because $42 = 42$) Discuss the commutative property for multiplication.
2. Write the equal sign on the board. Ask students to define *equal*. Discuss responses, and write the definition of *equal*: "Having the same amount or value." Refer back to the two commutative property equations, and explain that in each of them, the two sides of the equation are equal because they have the same *value*.
3. Write the following equation on the board: $6 + 4 = 3 + 7$. Ask students, "Is this a true statement? Why, or why not?" (Yes, because $10 = 10$) Discuss responses. For students who may not see how different numbers on each side of the equal sign can have the same value, share the visual at right. Remind students that they are looking for the same *value* on each side of the equation, not the same numbers.

$$\begin{array}{ccc} 6 + 4 & = & 3 + 7 \\ \swarrow \searrow & & \swarrow \searrow \\ 10 & = & 10 \end{array}$$
4. Challenge students to create more than one equation to make this statement true: $5 + 7 = \underline{\hspace{1cm}}$. If only addition equations are suggested, tell them that now they must create a subtraction problem to create a balanced equation, such as $5 + 7 = 20 - 8$. Challenge students to come up with various equations that involve other operations, listing all responses on the board. If needed, use the previous visual to illustrate correct and incorrect responses until you are sure students understand the concept of equality.
5. Now, show students that more than two addends can be used to show equality. Write the equation $6 + 5 + 7 = 7 + 6 + 5$ on the board, and share the visual at right. Also show that when three or more addends are grouped, such as $(6 + 5) + 7 = 6 + (5 + 7)$, the grouping does not affect the sum. This is known as the *associative property for addition*.

$$\begin{array}{ccc} 6 + 5 + 7 & = & 7 + 6 + 5 \\ \swarrow \downarrow \searrow & & \swarrow \downarrow \searrow \\ 18 & = & 18 \end{array}$$

6. Ask students to use the above strategy to solve this equation involving multiplication: $(3 \times 4) \times 2 = 3 \times (4 \times 2)$. Stress that just like the *associative property for addition*, the *associative property for multiplication* means that the grouping does not affect the product.



Assessment

- **Questions**
 - Can we assume that the associative property for multiplication will always work? Why, or why not?
 - Does the associative property for multiplication mean that we can change the order of the numbers *and* the grouping and still get the same product? Why, or why not?
- **Journal/Writing Prompts**
 - Explain the differences and similarities between the commutative property for addition and multiplication and the associative property for addition and multiplication.
 - Write five equations for a partner to solve. Your partner must come up with equivalent equations for each one you write.

Extensions and Connections (for all students)

- Give students one or more “Problems of the Day” to do daily. Good examples include:
 - $24 = \underline{\hspace{2cm}}$
 - $4 \times 5 = \underline{\hspace{1cm}} \times 10$
 - $3 \times 8 = 30 - \underline{\hspace{2cm}}$
- Challenge students to think deeper with problems such as:
 - $\$1.53 = \underline{\hspace{2cm}}$
 - $274 = \underline{\hspace{2cm}}$ (Broken Button Alert!: The 7 doesn’t work on your calculator, so you may not use 7 in your equations.)
- Have students complete the following at the end of the activity as an Exit Card:
 - Using the associative property for multiplication, complete the equation $(4 \times 2) \times 3 = \underline{\hspace{2cm}}$.
 - Complete the equation $4 \times 9 = \underline{\hspace{1cm}} \times 6$.
 - Complete the equation $3 + 4 + 7 = 2 \times \underline{\hspace{1cm}}$.
 - For $36 = \underline{\hspace{2cm}}$, write 3 equations. Use different operations.

Strategies for Differentiation

- Use manipulatives to show balance of sides.
- Pre-make sentence strip cards with equations that can be matched using the properties. Have students physically manipulate them.
- Make available to students a word bank of properties with examples.